FOREST RESEARCH REPORT

NOVA SCOTIA DEPARTMENT OF LANDS AND FORESTS
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SEASONAL INFLUENCE ON PLANTATION SURVIVAL AND GROWTH ON THE CAPE BRETON HIGHLANDS OF NOVA SCOTIA

INTRODUCTION

Many of Nova Scotia's forest stands are inadequately stocked to natural softwood regeneration after harvesting. In fact, Snow (1982) estimated that only 21% of five to six year-old softwood cutovers in Nova Scotia were greater than 60% stocked with naturally regenerated softwood species. Planting or fill planting is therefore necessary to restore softwood production on these sites. As a result, it is expected that the planting program in Nova Scotia will reach 37 million trees per year by 1990. From a logistics and operational standpoint, it would be much more convenient to plant these trees throughout the growing season rather than in the spring period only. In some regions of Canada, survival and height growth have been found to vary according to planting date, whereas, other studies have indicated that planting can take place from spring, throughout the summer months and into the fall without adversely affecting growth or survival (Anon., 1984; McClain, 1981; Mullin, 1968; Wood and Dominy, 1985). To determine the situation in Nova Scotia, biweekly planting trials were established at several locations. This report summarizes the results of the trials located on the Cape Breton Highlands.

SITE DESCRIPTION

Two five hectare clearcuts located on the Cape Breton Highlands were selected in 1984 for this trial, one along Park Spur Road and the other along Mile 22 East. Both stands were full-tree logged and then processed at roadside with a Hahn Harvester, leaving no slash or brush on the site. No further site preparation was carried out on either site.

The climate in this region is characterized by high rainfall levels, long winters and heavy snowfall. There are few periods during the growing season when there is a moisture deficiency at these sites (Dzikowski et al, 1984). During 1984, 665 mm of rain fell at the experimental sites during the period between May 23 and November 6. The average weekly rainfall during this period was 27.7 mm and varied from 0 mm for the week of October 10 to 99 mm during the week of August 8 (Figure 1). The corresponding province-wide averages were 486 mm for total rainfall and 20.2 mm for mean weekly rainfall.

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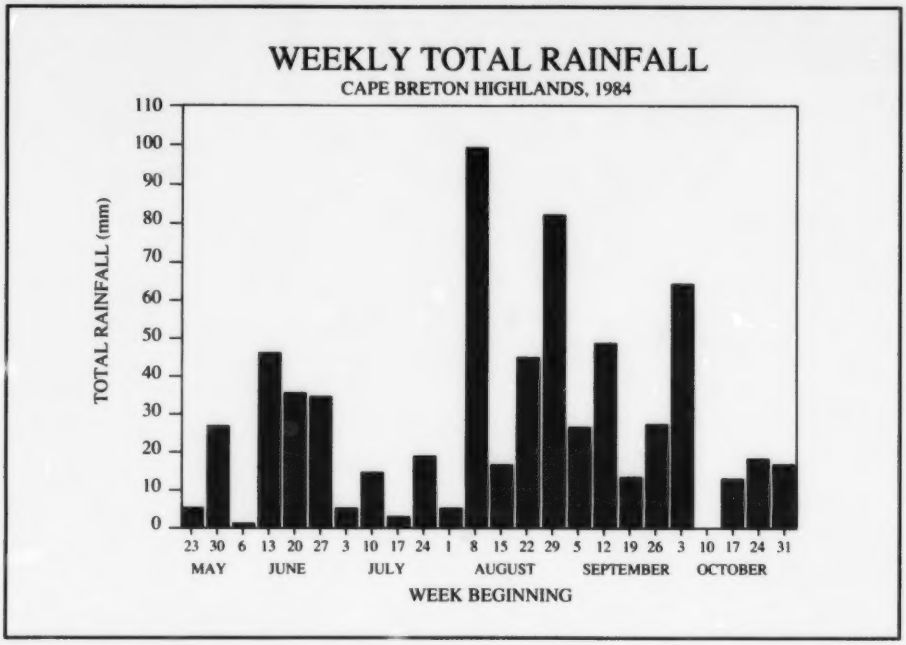

Figure 1. Weekly total rainfall on the Cape Breton Highlands from May 23 to November 6, 1984.

METHODS

Each site was divided into 56 blocks measuring 30.5 x 30.5 metres. These blocks were randomly assigned to one of 14 biweekly planting dates extending from May 17, 1984 to November 14, 1984 and with one of two species, black spruce (*Picea mariana* (Mill) B.S.P.) or white spruce (*Picea glauca* (Moench) Voss). Each planting date and species combination was replicated twice (Table 1).

The black spruce and white spruce trees were grown in multipots for two growing seasons at the Strathlorne nursery from Cape Breton Highland rooted cuttings and seed respectively. Stock quality measurements (heights, diameters, shoot/root ratios

Table 1. Species planted by date and block for both sites.

Date	Species	Blocks	Date	Species	Blocks
17/05/84	bS	5,15	20/08/84	wS	16,54
30/05/84	bS	12,35	05/09/84	bS	25,46
13/06/84	bS	7,52	05/09/84	wS	11,47
27/06/84	bS	6,32	18/09/84	bS	1,49
27/06/84	wS	36,45	18/09/84	wS	23,28
10/07/84	bS	10,18	02/10/84	bS	4,55
10/07/84	wS	22,34	02/10/84	wS	2,56
24/07/84	bS	27,43	16/10/84	bS	9,42
24/07/84	wS	19,51	16/10/84	wS	8,44
08/08/84	bS	31,53	31/10/84	bS	20,33
08/08/84	wS	26,38	31/10/84	wS	14,41
20/08/84	bS	17,48	04/06/85	wS	3,13

and oven dried weights) were recorded at the time of each planting (Table 2). All trees were planted with a dibble at 1.8 x 1.8 metre spacing.

The root systems of the white spruce trees were not fully developed during the first three planting dates and therefore were not planted. However, an early spring white spruce planting was carried out the following year at these sites. The November 14 planting was cancelled due to the sites being covered with snow.

Table 2. Stock quality measurements for black and white spruce at the time of planting.

Planting Date	Avg. Ht. (cm)	Avg. R.C. D. (mm)	O.D. Weight (g)	S/R Ratio
Black spruce				
May 17	14.8	2.64	2.6	1.4
May 30	16.2	3.54	3.1	1.3
June 13	17.2	3.36	2.1	1.7
June 27	18.2	3.01	2.5	1.5
July 10	19.7	3.25	2.9	1.5
July 24	21.1	3.32	2.9	1.6
Aug. 8	21.4	3.35	3.0	1.8
Aug. 20	17.6	2.91	3.2	1.3
Sept. 5	17.7	3.09	2.6	1.8
Sept. 18	17.3	2.97	2.2	1.6
Oct. 2	20.3	3.43	2.8	2.0
Oct. 16	22.5	3.57	2.4	2.8
Oct. 31	19.3	3.41	2.6	1.8
Nov. 14		not planted		
White spruce				
May 17		not planted		
May 30		not planted		
June 13		not planted		
June 27	15.6	2.19	1.6	2.1
July 10	14.2	2.56	1.8	1.9
July 24	19.4	3.07	2.4	2.1
Aug. 8	13.4	2.67	2.1	1.7
Aug. 20	18.8	3.00	2.6	2.1
Sept. 5	17.0	2.89	2.3	1.9
Sept. 18	17.3	2.91	2.5	1.8
Oct. 2	18.6	3.10	2.8	1.8
Oct. 16	17.4	3.07	2.2	2.1
Oct. 31	18.0	3.10	2.9	1.8
Nov. 14		not planted		
June 4/85	22.8	3.36	4.2	2.8

Ht. Seedling height (30 tree average)
R.C.D. Root collar diameter (30 tree average)
O.D. Oven dried
S/R Ratio of O.D. shoot weight to O.D. root weight

ASSESSMENT

An assessment of survival and growth was carried out in the fall of 1986 at both sites. Percent survival, leader length and total height of the trees were determined from five 2.1 m radius plots in each block. These plots were arranged systematically at the center of the block and 7.6 m from the center in the north, south, east and west directions. The severity of microsite, competing vegetation, browsing, frost damage and winter burning were also recorded.

Survival was expressed as both observed survival and projected survival where:

$$\text{observed survival} = \frac{\text{live trees}}{\text{live + dead trees}} \times 100$$

$$\text{projected survival} = \frac{\text{live trees}}{\text{live + dead + missing trees}} \times 100$$

RESULTS

SURVIVAL

The projected survival rates by planting date are shown separately for each species/site combination in Figure 2. There is little variation in survival by date within these combinations, although the black spruce planted on September 18 at Mile 22 East had noticeably lower survival than the remainder of the planting dates. This is an isolated case probably attributable to site conditions at Block 49 where the projected survival was only 25%.

Overall, black spruce had higher survival than white spruce and survival was greater at Park Spur than at Mile 22 East. For example, black spruce projected survival averaged 97% at Park Spur and 84% at Mile 22 East while white spruce projected survival averaged 94% and 67% respectively for the same sites (Table 3). The lower survival at Mile 22 East may be attributed to more severe competition at that site as compared to Park Spur (e.g. 40% of the white spruce seedlings were severely competed against at Mile 22 East versus 8% at Park Spur). At the time of assessment in 1986, the major competing species was raspberry (*Rubus* spp) at both sites while white birch (*Betula papyrifera* Marsh.) and mountain maple (*Acer spicatum* Lam.) were also major competitors at Mile 22 East.

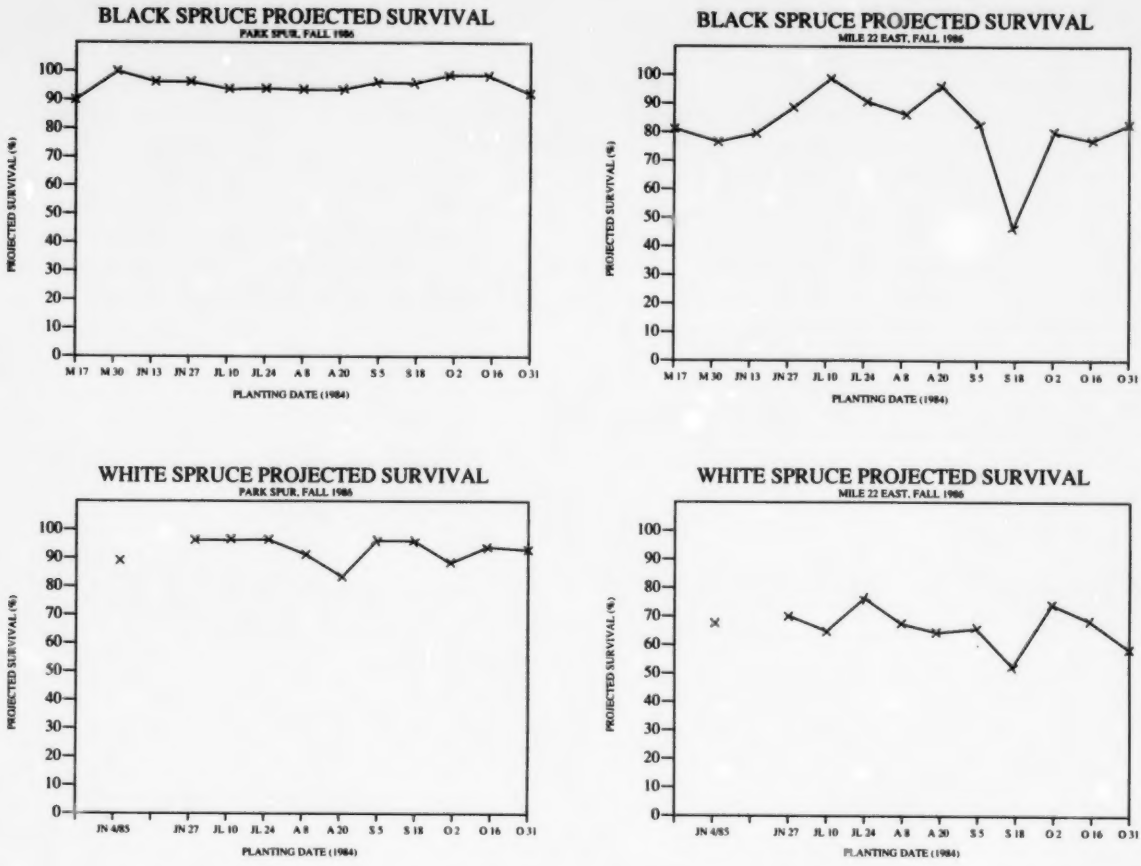

Figure 2. Projected survival rates by planting date for each species /site combination.

Table 3. Average percent survival* at Park Spur and Mile 22 East.

Site	Species	Observed Average Survival (%)	Projected** Average Survival (%)	Seedlings Severely Competed Against (%)
Park Spur	bS	99.6	96.5	4.2
	wS	96.6	93.9	7.9
Mile 22 East	bS	98.9	83.5	34.2
	wS	86.0	67,1	39.7

* Recorded in the fall of 1986.
** Projected survival includes missing trees.

HEIGHT

Average total tree height by planting date is shown in Figure 3 for each species/site combination. There is a slight decreasing trend of total height with later planting dates. This trend is most pronounced for the black spruce at Park Spur, where the total height averaged 8.0 cm higher for the earliest planting date (May 17) as opposed to the latest (Oct. 31) planting date. The sites will be remeasured at five year intervals to determine longer term height trends.

Total height was slightly greater for the black spruce trees and for those seedlings planted at Park Spur. The lowest heights generally resulted from the September plantings and the greatest heights from the May to July planting dates (Table 4).

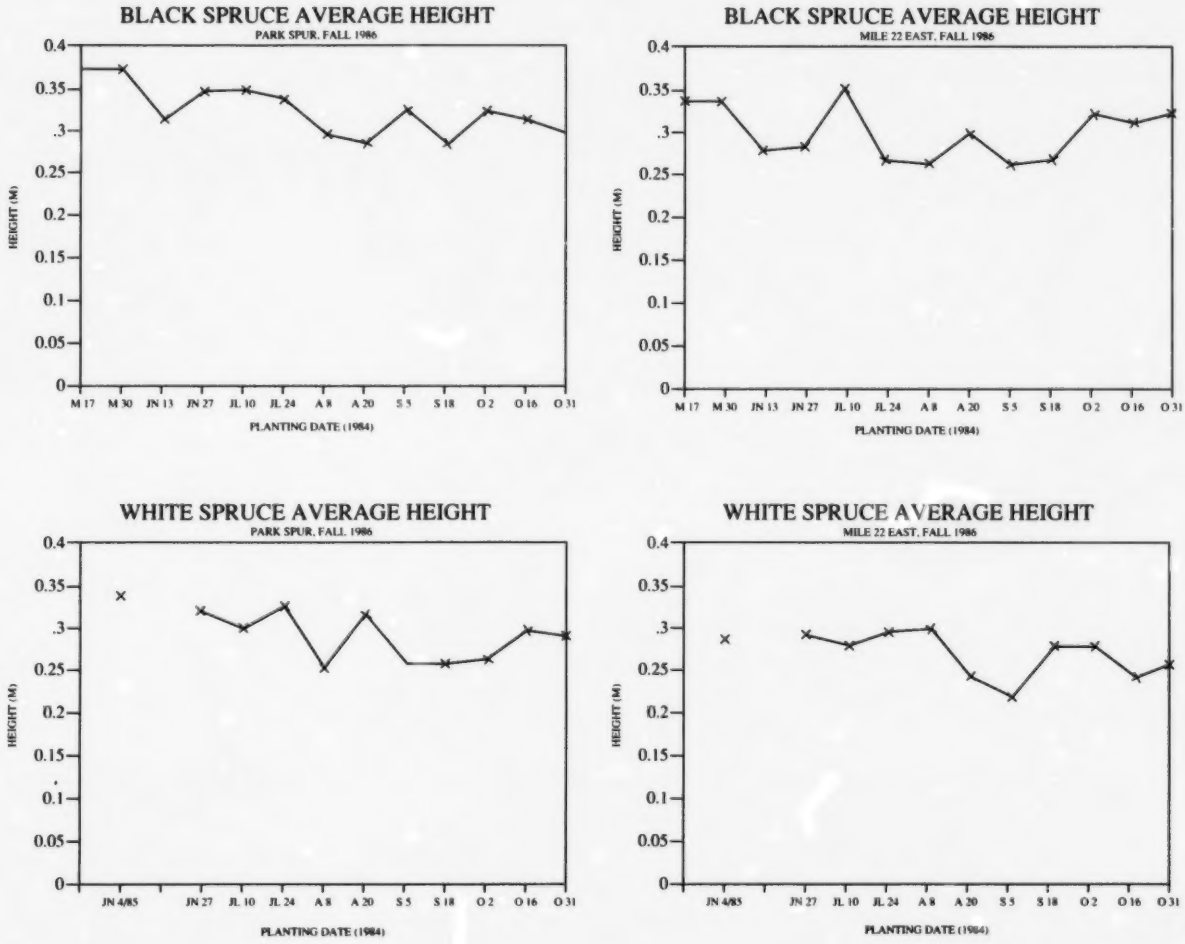

Figure 3. Total tree height by planting date for each species/site combination.

Table 4. Mean height and planting date of highest and lowest height* for each species /site combination.

Site	Species	Height (cm) (Date)		
		Average	Lowest	Highest
Park Spur	bs	32.5	28.5(19/9/84)	37.5(17/5/84) (30/5/84)
	ws	29.3**	26.0(19/9/84)	34.0 (4/6/85)
Mile 22 East	bs	29.8	26.0 (9/8/84) (6/9/84)	35.0(10/7/84)
	ws	27.1**	22.0 (6/9/84)	30.0 (9/8/84)

* Heights measured in the fall of 1986
** Including the spring 1985 planting date

DISCUSSION

In the unique eco-climate of the Cape Breton Highlands, where moisture is usually non-limiting throughout the growing season, black spruce and white spruce can be planted from mid-May to the end of October with good survival expected, provided these plantations are properly maintained.

Overall, survival and total tree height were higher at Park Spur than at Mile 22 East. This may be attributed to the greater amounts of competing vegetation at the Mile 22 East site where 37% of the planted trees were under severe competition compared to 6% at Park Spur. Survival and total tree height were also slightly higher for black spruce as compared to white spruce. Others (e.g. Fowells, 1965; Wood and Dominy, 1985) have also indicated that black spruce initially outgrows white spruce in height.

These results do not necessarily apply to mainland Nova Scotia sites where soil moisture deficiencies are more common than on the Cape Breton Highlands (Dzikowski et al., 1984). Results of trials initiated on mainland Nova Scotia will be published at a later date.

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